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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
CUNNINGHAM, GREGORY F	

ART UNIT	PAPER NUMBER
2676	

DATE MAILED: 12/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/795,991	SHIN ET AL.	
	Examiner	Art Unit	
	Greg Cunningham	2676	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *36-67* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *36-67* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/20/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to communications of application filed 3/10/2004.

2. The disposition of the claims is as follows: claims 36-67 are pending in the application. Claims 36 and 51 are independent claims. Claims 1-35 were cancelled.

3. The group and/or Art Unit location of your application has changed. To aid in the correlation of any papers for this application, all further correspondence should be directed to Group Art Unit 2676 (effective 12/04). Please be sure to use the most current art unit number on all correspondence to help us route your case and respond to you in a timely fashion.

4. When making claim amendments, the applicant is encouraged to consider the references in their entireties, including those portions that have not been cited by the examiner and their equivalents as they may most broadly and appropriately apply to any particular anticipated claim amendments.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

6. Claims 36, 37, 39-53 and 55-67 are rejected under 35 U.S.C. 102(a) as being unpatentable over Murakawa (US Patent 6,381,365).

A. Per claim 36, "A computer readable medium having program codes executable by a computer to perform a method for describing texture features of an image, the method comprising:

(a) generating a regularity indicator indicating regularity of the image"; is described in col. 11, lns. 24-31 at "As will be known from the preceding description, the image processing system of the invention obtains information indicative of whether spatial periodicity is present in the scanned image, and stores this information in the form of the above-noted periodicity flag. When periodicity is detected, the <u>direction</u> and period of a first period, and the <u>direction</u> and period of a second period, are obtained and stored as <u>texture</u> features.";

"(b) generating a direction indicator indicating direction of the image"; is described, supra for part (a) and in col. 11, lns. 32-35 at "Furthermore, while the first and second <u>direction</u> features alone are meaningful as <u>texture</u> features, the <u>direction</u> and period information can be used to extract a partial image that can be used as a <u>pattern</u> for generating image <u>textures</u>.";

"(c) generating a scale indicator indicating scale of the texture element of the image"; is described in col. 8, lns. 34-41 at "This normalization process reduces or enlarges the <u>image</u> to a standard <u>image size</u> as a means of reducing the processing time and reducing noise during <u>image</u> processing. In the present embodiment, images are reduced to fit a 120.times.120 pixel area while retaining the original aspect ratio. (41) The normalized <u>image</u> data is then converted to a <u>gray-scale image</u> and digitized (S303)."

"(d) expressing a texture descriptor of the image using the regularity indicator, the direction indicator and the scale indicator" is described, supra for elements (a)-(c) in col. 3, lns 6-14 at "In further aspect of this invention, an image data processing apparatus processes image

data for a pixel image wherein a plurality of pixels are arranged in a matrix pattern and the pixel image has a texture pattern. To process the image data, this image data processing apparatus uses an extraction controller for extracting feature information descriptive of an image texture using pixel data for pixels located in a scanning band oriented in a specific direction through the image."

Therefore "image searching can be performed with good precision by extracting the basic texture pattern of an image as a feature of the image, and comparing images using these detected basic texture patterns" as revealed in col. 2, lines 11-14.

B. Per claim 37, "The computer readable medium of claim 36, wherein the regularity of the image is expressed as one of a plurality of predetermined values" is described in col. 19, lns. 50-60 at "Using these parameters, similarity D can be calculated from the following equation:

D=(W0.times.P0+W1.times.P1+W2.times.P2)/(W0+W1+W2) (18)

where W0, W1, and W2 are the weights assigned to P0, P1, and P2, respectively, and W0>W1 >W2. The greater the value of D, the greater the similarity between the two images. The value of D is therefore compared with a predetermined threshold value to determine image similarity."

C. Per claim 39, "The computer readable medium of claim 36, wherein the regularity indicator comprises a quantized integer" is described, supra for claim 36, and in col. 19, lns. 31-35 at "A example of calculating similarity between the key image and a comparison image in step S604 above is described below. Image similarity can be calculated by **quantifying** the proximity in two images between pixels with a gray level of 1."; and in col. 20, lines 24-26 at "When searching for an image similar to a key image, an image data processing apparatus

according to the present it can easily compare and determine whether two images are similar by evaluating image similarity based on the basic <u>texture pattern</u> extracted from the image".

D. Per claim 40, "The computer readable medium of claim 36, wherein the direction of the image is expressed as one of a plurality of predetermined values" is described, supra for claim 36, and in col. 7, lns. 14-31 at "Because gray level occurrence is directly related to the periodicity of the <u>texture pattern,</u> the periodicity of a <u>texture</u> should be reflected in S.sub..theta. (i,j.vertline.d). Whether such periodicity exists is determined from a graph of inertia values obtained at distance d, where d ranges from 3, 4, . . . d.sub.max where d.sub.max is the greatest distance d), for each direction .theta.. This method of evaluation is described below. (29) The first step is to obtain inertia I[S.sub..theta. (d)] at each distance d for each direction .theta., and then obtain the lowest inertia value I.sub.ner (.theta.) from the set of inertia values I[S.sub.74 (d)] in each direction .theta.. I.sub.ner (.theta.) is obtained by the following equation (5) I.sub.ner (.theta.)=Min(I[S.sub..theta. (3)], I[S.sub..theta. (4)], . . . , I[S.sub..theta. (d.sub.max)]) (6) (30) The smallest and second-smallest values are then selected from I.sub.ner (0), I.sub.ner (45), I.sub.ner (90) and I.sub.ner (135). If the lowest of the selected inertia values I.sub.ner (.theta.) is less than a predetermined threshold value, the texture is determined to have a periodic characteristic."

E. Per claim 41, "The computer readable medium of claim 36, wherein the direction of the image is expressed as one of values, 'no directionality', '0 degrees', '30 degrees', '60 degrees', '90 degrees', '120 degrees', and '150 degrees' " is disclosed, supra for claim 36, and in col. 7, lns. 32-43 at "This is illustrated further in FIG. 5, a graph of inertia I at multiple distances d for a particular pixel in each of four directions .theta.. In the example shown, the minimum inertia

I.sub.ner value was obtained at a distance d=7 for direction .theta.=0.degree., at distance d=7 for direction .theta.=45.degree., at distance d=13 for direction .theta.=90.degree. and at distance d=6 for direction .theta.=135.degree.. I.sub.ner (135) thus has the lowest inertia I of any direction, and I.sub.ner (45) has the second lowest inertia. Both I.sub.ner (135) and I.sub.ner (45) are also below the threshold value to determine periodicity, and it is therefore determined that the image texture has a periodic characteristic at both direction .theta.=45.degree. and 135.degree.." and in col. 9, lns. 23-31 at "It should be noted that texture orientation can be determined with greater directional precision by using a smaller angle increment between scanning directions. For example, if the angle increment used for gray level co-occurrence matrix calculation is 10 degrees, the scanning direction .theta.=0.degree. when n=0, .theta.=10.degree. when n=1, .theta.=20.degree. when n=2, and so forth. This, however, increases the number of calculation processes that must be executed, and thus increases the processing time required. An increment of 45.degree. is therefore used in the present embodiment."

F. Per claim 42, "The computer readable medium of claim 36, wherein the direction indicator comprises a quantized integer" is described, supra for claims 36 and 41, wherein directions exemplified are quantized integers.

G. Per claim 43, "The computer readable medium of claim 36, wherein the scale of the texture element is expressed as one of a plurality of predetermined values" is described, supra for claim 36, and in col. 8, lns. 40-51 at "The normalized image data is then converted to a gray-scale image and digitized (S303). To address the problem of the digitizing process described in the above review of related technologies, the threshold value is not set to a pixel value with a high frequency of appearance, but is rather set to a value offset a predetermined amount above or

below a median pixel value of a pixel value distribution after gray-scale conversion. This is described specifically below.

(42) FIG. 10 is a graph of the pixel value distribution in relation to the pixel values after gray scale conversion for a certain image. There are 256 gradations possible in the present example."

H. Per claim 44, "The computer readable medium of claim 36, wherein the scale of the texture element is expressed as one of values, 'fine', 'medium', 'course', and 'very course' " is disclosed, supra for claim 36, and in col. 6, lns. 36-52 at "This method is based on evaluating a two-dimensional probability density function f(i,j.vertline.d,.theta.) where the probability density function f(i,j.vertline.d,.theta.) indicates the likelihood of a pixel separated distance d in direction .theta. from a pixel having a gray level i having a gray level j. The gray level co-occurrence matrix is a matrix of functions f(i,j.vertline.d,.theta.) for each (d, .theta.), i and j indicating row and column positions, respectively. When the texture is coarse and the distance d is small relative to the size of the component elements of the texture, a pixel pair separated (d,.theta.) generally have similar gray levels, and the values proximal to diagonal elements of the gray level co-occurrence matrix are thus relatively high. Conversely, if the texture is fine and distance d is roughly equivalent to the size of the component elements of the texture, there is a higher probability that any (d,.theta.) pixel pair will be a pair of dissimilar gray levels, and there will be a relatively uniform distribution across all elements of the co-occurrence matrix."

J. Per claim 45, "The computer readable medium of claim 36, wherein the scale indicator comprises a quantized integer" is described, supra for claims 36 and 43. Wherein there are 256 quantized gradations.

K. Per claim 46, "The computer readable medium of claim 36, wherein the texture descriptor of the image is expressed as a vector of the regularity indicator, the direction indicator, and the scale indicator" is disclosed, supra for claim 36, and in col. 6, ln. 31 – col. 7, ln. 3 at "Methods using a gray level co-occurrence matrix (GLCM) for texture analysis are known from the literature, and are described in detail in, for example, "Basics of image recognition II: feature extraction, edge detection, and texture analysis" (in Japanese, by Shunji Mori et al.; Ohmsha).

(22) This method is based on evaluating a two-dimensional probability density function f(i,j.vertline.d,.theta.) where the probability density function f(i,j.vertline.d,.theta.) indicates the likelihood of a pixel separated distance d in direction .theta. from a pixel having a gray level i having a gray level j. The gray level co-occurrence matrix is a matrix of functions f(i,j.vertline.d,.theta.) for each (d, .theta.), i and j indicating row and column positions, respectively. When the texture is coarse and the distance d is small relative to the size of the component elements of the texture, a pixel pair separated (d,.theta.) generally have similar gray levels, and the values proximal to diagonal elements of the gray level co-occurrence matrix are thus relatively high. Conversely, if the texture is fine and distance d is roughly equivalent to the size of the component elements of the texture, there is a higher probability that any (d,.theta.) pixel pair will be a pair of dissimilar gray levels, and there will be a relatively uniform distribution across all elements of the co-occurrence matrix.

(23) When building the gray level co-occurrence matrix in the present embodiment, the image is scanned in four directions .theta. at angles of 0, 45, 90, and 135 degrees passing through a center of the image as shown in FIGS. 4A to 4D and described in further detail below. Matrice

S.sub..theta. (d) is defined as shown by equations (1) to (4) below using the gray level co-occurrence matrix M(d,.theta.).

(1) S.sub.0 (d)=[M(d,0.degree.)+M.sup.t (d,0.degree.)]/2 (1)

(2) S.sub.45 (d)=[M(d,45.degree.)+M.sup.t (d,45.degree.)]/2 (2)

(3) S.sub.90 (d)=[M(d,90.degree.)+M.sup.t (d,90.degree.)]/2 (3)

(4) S.sub.135 (d)=[M(d,135.degree.)+M.sup.t (d,135.degree.)]/2 (4)

(24) where M.sup.t (d,.theta.) is a transposed matrix of M(d,.theta.).

(25) These matrices can be used to calculate various feature quantities, construct a feature space, and discriminate textures." Wherein matrix notation correspond to abbreviated representation of vectors.

L. Per claim 47, "The computer readable medium of claim 36, wherein the direction indicator comprises a dominant direction of the image" is disclosed, supra for claim 36, and in col. 3, lns. 8-14 at "To process the image data, this image data processing apparatus uses an extraction controller for extracting feature information <u>descriptive of an image texture</u> using pixel data for pixels located in a scanning band oriented in a specific <u>direction</u> through the image." Wherein "a specific direction" corresponds to "dominant direction".

M. Per claim 48, "The computer readable medium of claim 47, wherein the scale indicator comprises a scale corresponding to the dominant direction of the image" is disclosed, supra for claim 47 and furthermore in col. 14, lns. 43-51 at "The normalized <u>image</u> data is then converted to a gray<u>-scale image</u> and digitized (S503). Using the normalized, gray<u>-scale,</u> digital <u>image</u> data, the <u>image</u> is then analyzed to determine the periodicity of <u>image</u> textures (S504).

(106) Periodicity is here defined as the repetition of a same pattern at a certain spatial interval (period or distance d) in a particular direction .theta. with a frequency exceeding a certain threshold value. This periodicity characteristic can thus be represented by distance d and direction .theta.." Wherein "a particular direction" corresponds to "dominant direction".

N. Per claim 49, "The computer readable medium of claim 48, wherein the direction indicator comprises a first direction indicator and a second direction indicator comprising a first dominant direction of the image and a second dominant direction of the image, respectively" is disclosed, supra for claim 36 and furthermore in col. 15, lns. 9-15 at "Exemplary criteria used for this determination in the present embodiment are whether the texture pattern occurs at a regular period in at least two directions. If periodicity is detected in more than two directions, the two directions with the greatest periodicity, that is, the greatest frequency of appearance, are selected as the directions in which periodicity is present."

O. Per claim 50, "The computer readable medium of claim 49, wherein the scale indicator comprises a first scale indicator comprising a scale corresponding to the first dominant direction of the image and a second scale indicator comprising a scale corresponding to the second dominant direction of the image" is disclosed, supra for claim 49 and furthermore in col. 15, lns. 22-27 at "Let us assume, for example, that periodicity (direction .theta., distance d) was detected at both (0.degree., 3) and (45.degree., 2) as a result of texture analysis. The basic pattern of the image texture is then extracted based on the detected directions and distances. The basic pattern in this case could be as shown in FIG. 16A." Wherein distances "3" and "2" are "first scale indicator" and "second scale indicator" respectively.

P. Per claim 51, "The computer readable medium of claim 50, wherein the texture descriptor of the image comprises a vector of the regularity indicator, the first direction indicator, the second direction indicator, the first scale indicator, and the second scale indicator" is disclosed, supra for claims 49 and 50. Wherein "both (0.degree., 3) and (45.degree., 2)" are vectors with direction and magnitude.

Q. Per independent claim 52, this is directed to an apparatus for performing the computer readable medium to perform a method of independent claim 36, and therefore is rejected to independent claim 36.

R. Per dependent claims 53 and 55-67, these are directed to an apparatus for performing the computer readable medium to perform a method of dependent claims 37 and 39-51, and therefore are rejected to dependent claims 37 and 39-51.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 38 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakawa as applied to claims 36 and 37 above, and further in view of Energy-based methods in vibroacoustics, by Brian Mace & Eric Wester.

A. Per claim 38, "The describing method according to claim 36, wherein the step (a) comprises generating the regularity indicator expressing the regularity of the image as one of

values, 'irregular', 'slightly irregular', 'regular', 'highly regular' " is disclosed, supra for claims 36 and 37, and in col. 19, ln. 56 – col. 20, ln. 4 at "The greater the value of D, the greater the similarity between the two images. The value of D is therefore compared with a predetermined threshold value to determine image similarity. That is, when D is greater than a particular threshold value, the comparison image is determined to be similar to the key image.

As described above, an image data processing apparatus according to the present embodiment extracts a basic texture pattern based on the periodicity and direction of basic image elements, normalizes the extracted basic pattern, shifts the elements toward the center of the pattern, and then stores the resulting basic pattern information as an identifying feature of the source image. Images can then be compared on the basis of the basic texture patterns extracted therefrom to enable efficient image comparison and searching." Although Murakawa does not disclose specific terms such as 'irregular', 'slightly irregular', 'regular', 'highly regular', but rather only classifies similarity of image according to a numerical value "D" he could have easily associated values for similarity to 'irregular', 'slightly irregular', 'regular', 'highly regular' such as Brian Mace & Eric Wester do with energy flow at "Traditional SEA estimates of the ensemble averaged vibrational energy flow from directly to indirectly excited subsystems are generally greater, and often significantly greater, than the true flow. The largest errors occur when the coupling between subsystems is strong, and any of the subsystems are rectangular or otherwise **highly regular**. An important source of error lies in the effect, neglected in traditional estimates of averaged flow, of coherent interaction between waves incident on either side of the coupling. The wave field is expressed in the present work, by Fourier decomposition parallel to the coupling, as a superpostion of wave components which propagate in directions perpendicular to

the coupling. Except in the case of **very regular** systems, the energy associated with any given wave component is scattered into other wave components as it propagates. Although this scattered power is an important part of the total coupling power, it contributes negligibly to the coherent power in most systems. The validity of this statement and its use in calculating an estimate of the coherent power is investigated, and an improved estimate of the ensemble averaged coupling power is presented and compared with both traditional SEA and exact powers."

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply similarity comparisons disclosed by Murakawa in combination with specific comparison terms such as 'irregular', 'slightly irregular', 'regular', 'highly regular' disclosed by Brian Mace & Eric Wester, and motivated to combine the teachings because image searching can be performed with good precision by extracting the basic texture pattern of an image as a feature of the image, and comparing images using these detected basic texture patterns as revealed in col. 2, lines 11-14.

B. Per dependent claim 54, this is directed to an apparatus for performing the computer readable medium to perform a method of dependent claim 38, and therefore is rejected to dependent claim 38.

Responses

9. Responses to this action should be mailed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231. If applicant desires to fax a response, (703) 872-9306 may be used for formal communications.

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA., Sixth Floor (Receptionist).

Inquiries

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Greg Cunningham whose telephone number is (703) 308-6109.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella, can be reached on (703) 308-6829.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9306 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

G.F. Cunningham, Examiner

gfc

December 13, 2004

Matthew C. Bella

MATTHEW C. BELLA
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